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Tsai et al.

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(45) **Date of Patent: Feb. 9, 2016**

(54) **METHOD OF IDENTIFYING PALM AREA FOR TOUCH PANEL AND METHOD FOR UPDATING THE IDENTIFIED PALM AREA**

(75) Inventors: **Yu-Jen Tsai**, Taichung (TW); **Hsueh-Wei Yang**, Zhubei (TW)

(73) Assignee: **ELAN MICROELECTRONICS CORPORATION**, Hsinchu (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 934 days.

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(22) Filed: **May 10, 2012**

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(30) **Foreign Application Priority Data**

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Aug. 11, 2011 (TW) ..... 100128653 A

(51) **Int. Cl.**
G06K 9/00 (2006.01)
G06F 3/041 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 3/0416*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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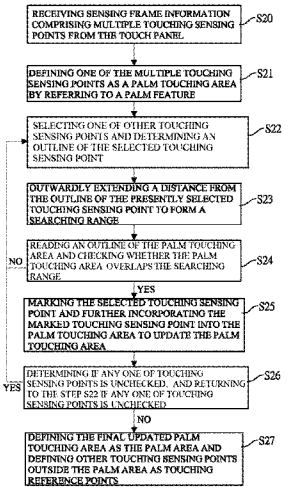
Primary Examiner — Wesley Tucker
(74) *Attorney, Agent, or Firm* — patenttm.us

(57) **ABSTRACT**

A method of identifying a palm area for a touch panel has steps of: receiving sensing frame information having multiple touching sensing points from the touch panel; selecting one of the touching sensing points; outwardly extending a distance from an outline of the selected touching sensing point to define a searching range; checking whether other touching sensing points are within the searching range; marking the touching sensing points in the searching range and expanding the searching range based on the currently marked touching sensing points; sequentially selecting and checking each touching sensing point if it is within the present searching range; and finally merging all the outlines of the marked touching sensing points to form a final outline as a palm area. Other unmarked touching sensing points are defined as touching reference points.

21 Claims, 16 Drawing Sheets



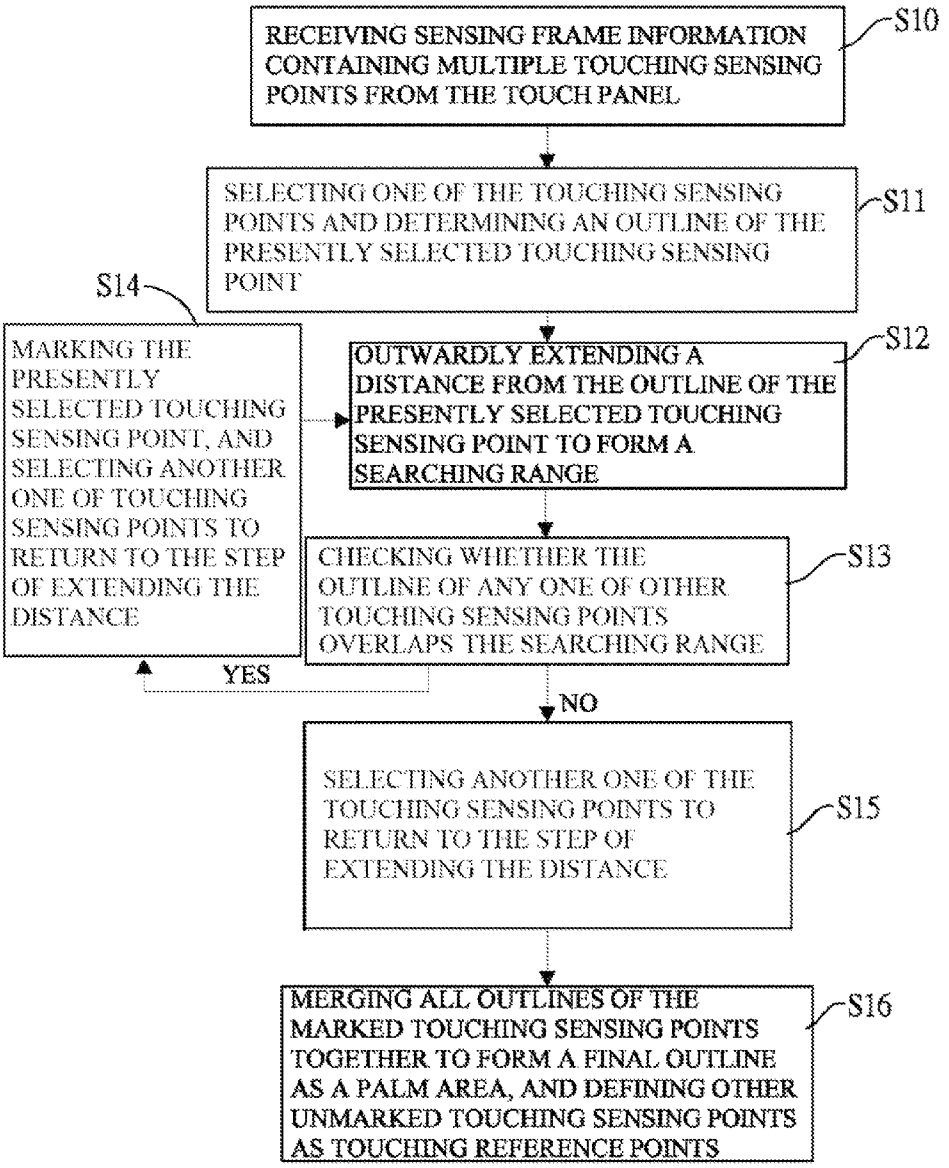

RECEIVING SENSING FRAME INFORMATION CONTAINING MULTIPLE TOUCHING SENSING POINTS FROM THE TOUCH PANEL
S10
SELECTING ONE OF THE TOUCHING SENSING POINTS AND DETERMINING AN OUTLINE OF THE PRESENTLY SELECTED TOUCHING SENSING POINT
S11
S14
MARKING THE PRESENTLY SELECTED TOUCHING SENSING POINT, AND SELECTING ANOTHER ONE OF TOUCHING SENSING POINTS TO RETURN TO THE STEP OF EXTENDING THE DISTANCE
OUTWARDLY EXTENDING A DISTANCE FROM THE OUTLINE OF THE PRESENTLY SELECTED TOUCHING SENSING POINT TO FORM A SEARCHING RANGE
S12
CHECKING WHETHER THE OUTLINE OF ANY ONE OF OTHER TOUCHING SENSING POINTS OVERLAPS THE SEARCHING RANGE
S13
YES
NO
SELECTING ANOTHER ONE OF THE TOUCHING SENSING POINTS TO RETURN TO THE STEP OF EXTENDING THE DISTANCE
S15
MERGING ALL OUTLINES OF THE MARKED TOUCHING SENSING POINTS TOGETHER TO FORM A FINAL OUTLINE AS A PALM AREA, AND DEFINING OTHER UNMARKED TOUCHING SENSING POINTS AS TOUCHING REFERENCE POINTS
S16

FIG. 1

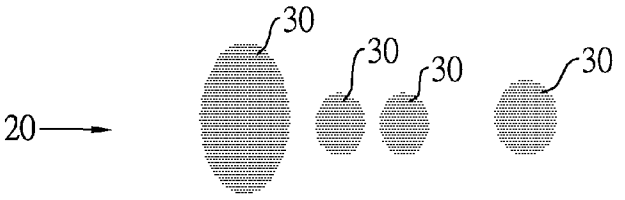


FIG. 2A

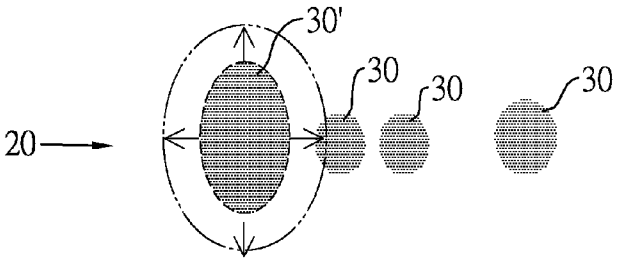


FIG. 2B

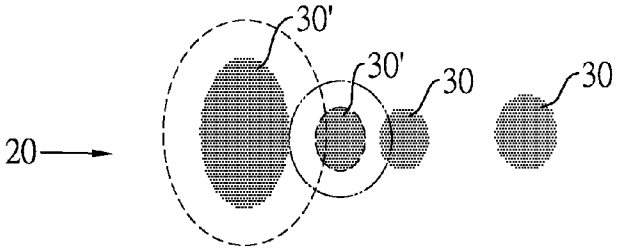


FIG. 2C

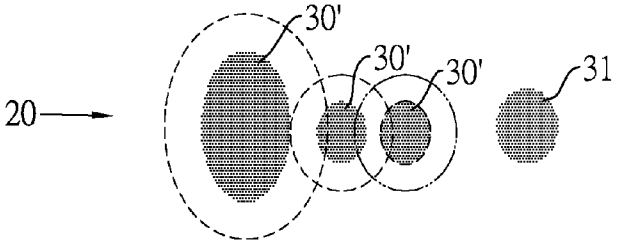


FIG. 2D

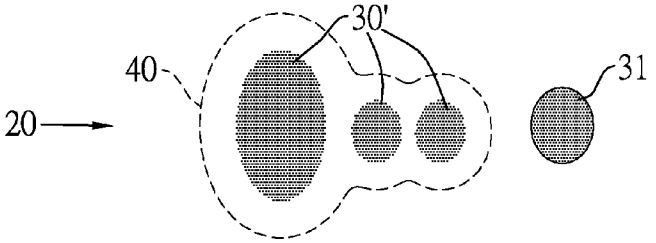


FIG. 2E

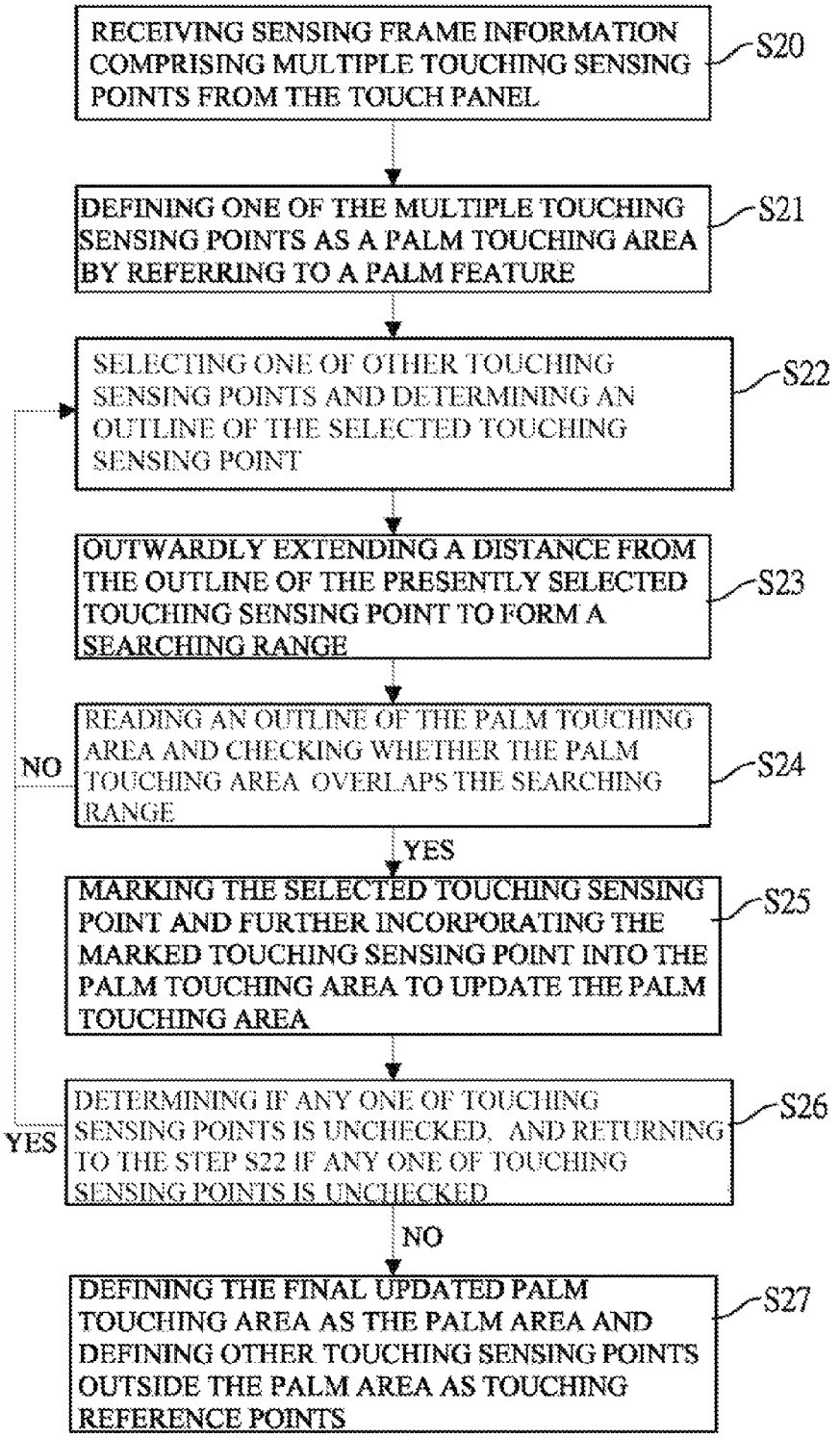

RECEIVING SENSING FRAME INFORMATION COMPRISING MULTIPLE TOUCHING SENSING POINTS FROM THE TOUCH PANEL
S20
DEFINING ONE OF THE MULTIPLE TOUCHING SENSING POINTS AS A PALM TOUCHING AREA BY REFERRING TO A PALM FEATURE
S21
SELECTING ONE OF OTHER TOUCHING SENSING POINTS AND DETERMINING AN OUTLINE OF THE SELECTED TOUCHING SENSING POINT
S22
OUTWARDLY EXTENDING A DISTANCE FROM THE OUTLINE OF THE PRESENTLY SELECTED TOUCHING SENSING POINT TO FORM A SEARCHING RANGE
S23
READING AN OUTLINE OF THE PALM TOUCHING AREA AND CHECKING WHETHER THE PALM TOUCHING AREA OVERLAPS THE SEARCHING RANGE
S24
NO
YES
MARKING THE SELECTED TOUCHING SENSING POINT AND FURTHER INCORPORATING THE MARKED TOUCHING SENSING POINT INTO THE PALM TOUCHING AREA TO UPDATE THE PALM TOUCHING AREA
S25
DETERMINING IF ANY ONE OF TOUCHING SENSING POINTS IS UNCHECKED, AND RETURNING TO THE STEP S22 IF ANY ONE OF TOUCHING SENSING POINTS IS UNCHECKED
S26
YES
NO
DEFINING THE FINAL UPDATED PALM TOUCHING AREA AS THE PALM AREA AND DEFINING OTHER TOUCHING SENSING POINTS OUTSIDE THE PALM AREA AS TOUCHING REFERENCE POINTS
S27

FIG. 3

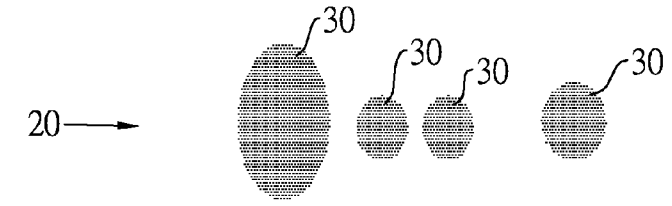


FIG. 4A

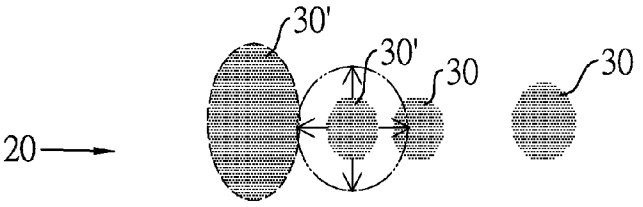


FIG. 4B

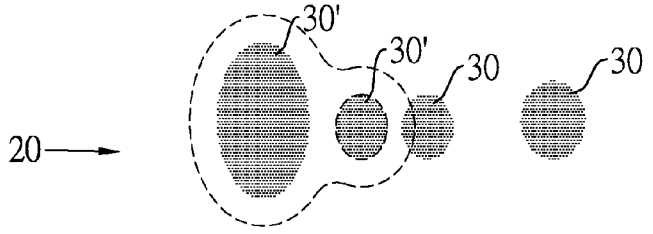


FIG. 4C

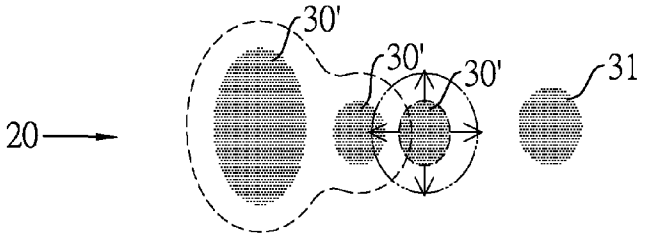


FIG. 4D

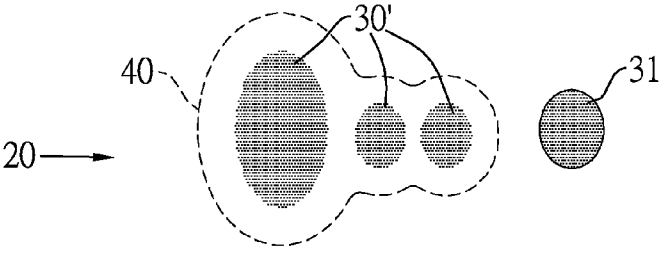


FIG. 4E

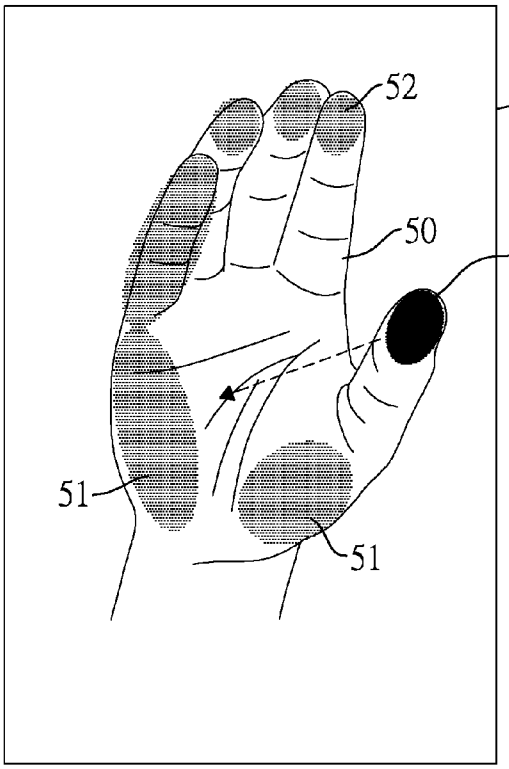


FIG. 5A

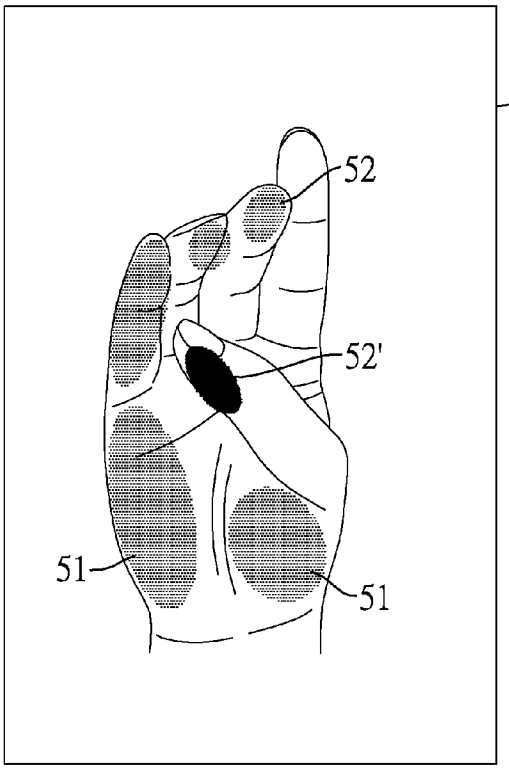


FIG. 5B

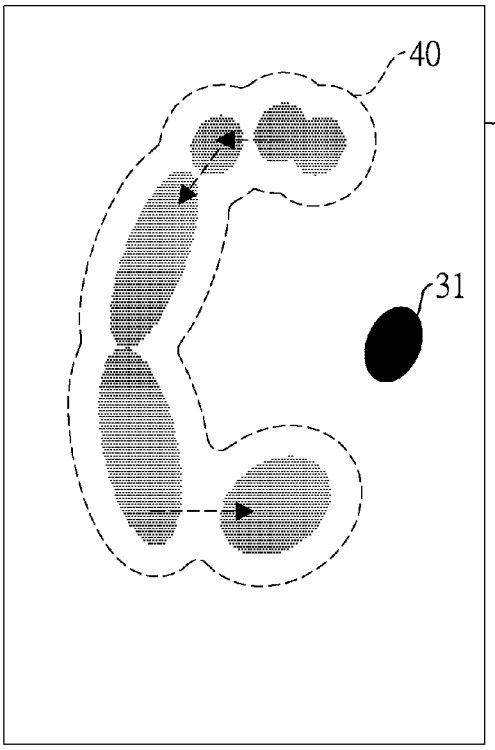


FIG. 6A

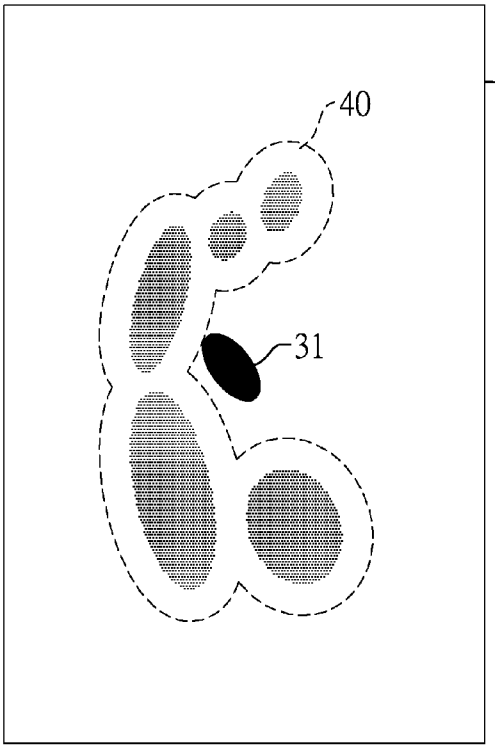


FIG. 6B

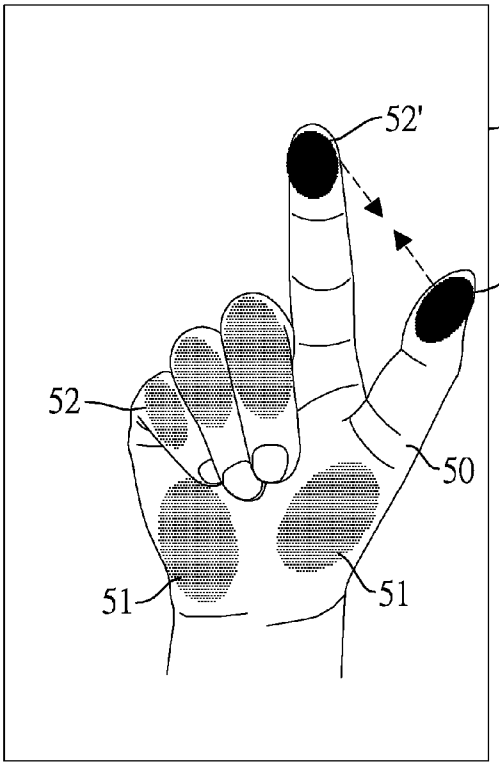


FIG. 7A

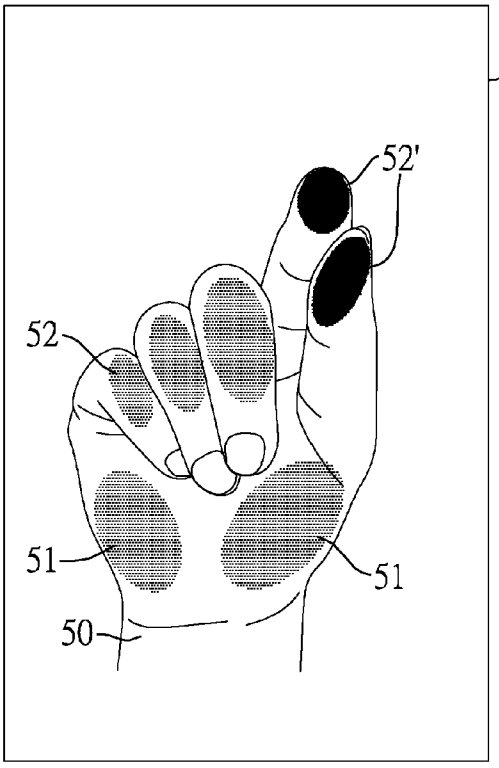


FIG. 7B

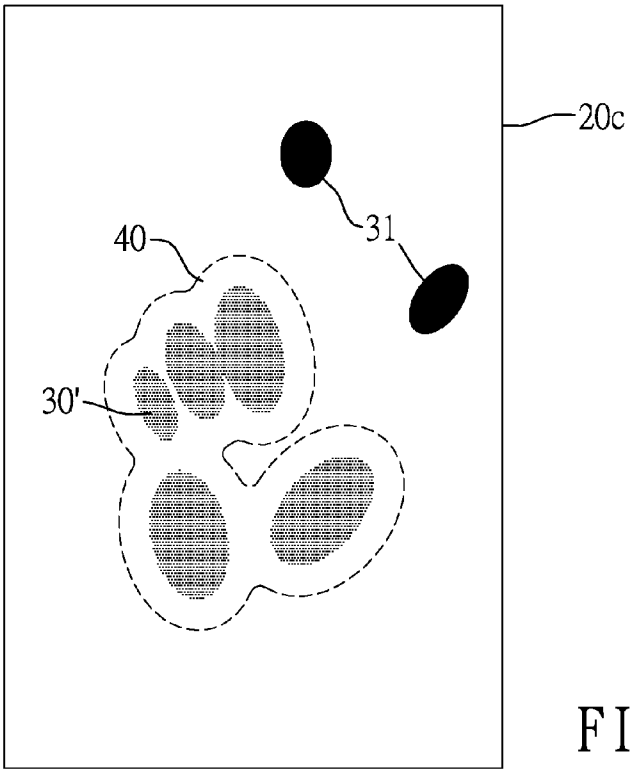


FIG. 8A

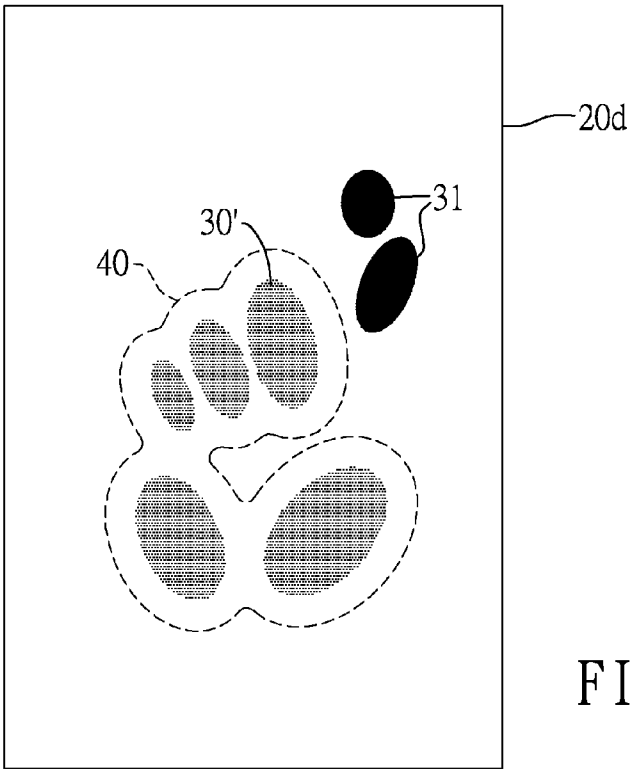


FIG. 8B

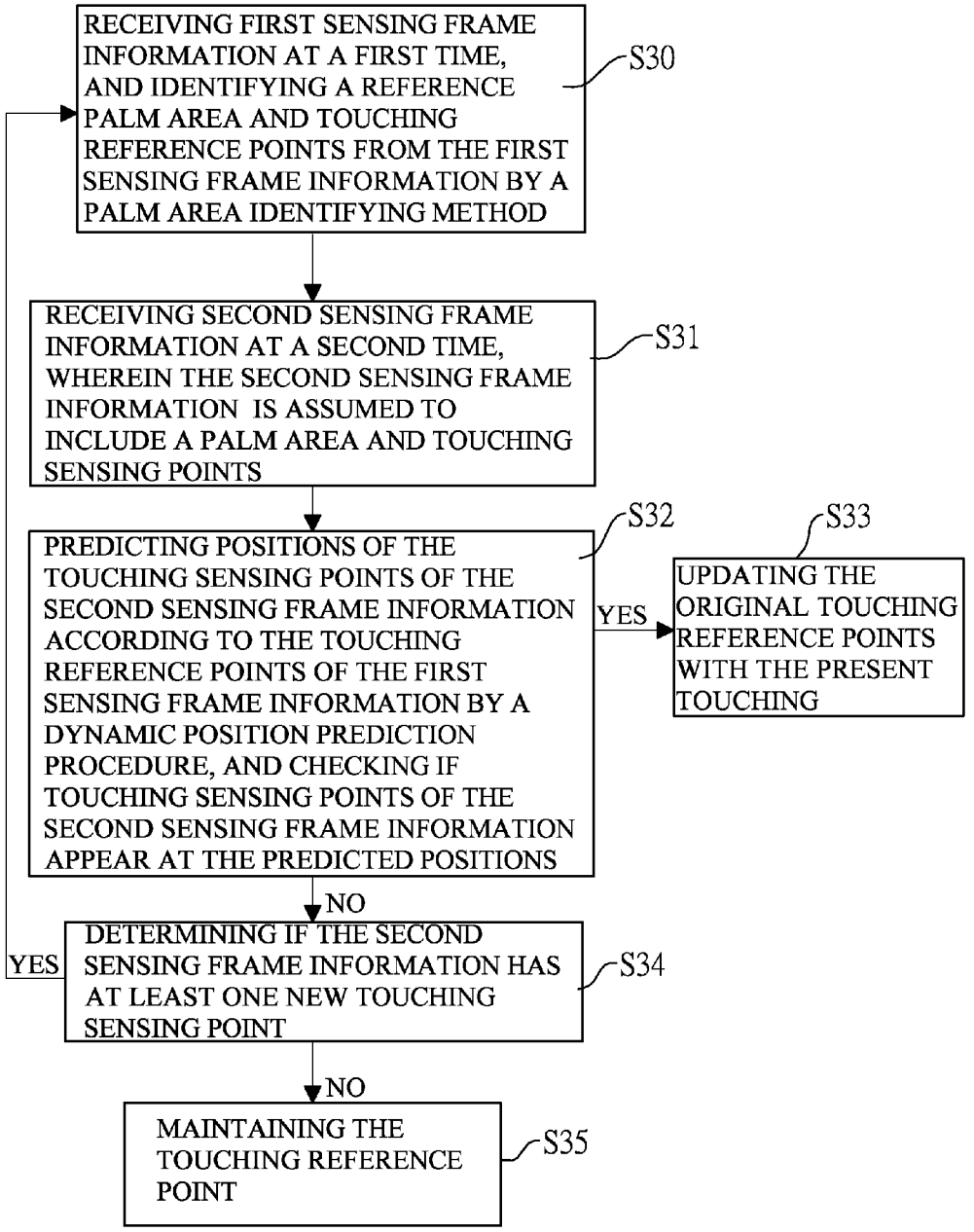

RECEIVING FIRST SENSING FRAME INFORMATION AT A FIRST TIME, AND IDENTIFYING A REFERENCE PALM AREA AND TOUCHING REFERENCE POINTS FROM THE FIRST SENSING FRAME INFORMATION BY A PALM AREA IDENTIFYING METHOD
S30
RECEIVING SECOND SENSING FRAME INFORMATION AT A SECOND TIME, WHEREIN THE SECOND SENSING FRAME INFORMATION IS ASSUMED TO INCLUDE A PALM AREA AND TOUCHING SENSING POINTS
S31
PREDICTING POSITIONS OF THE TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION ACCORDING TO THE TOUCHING REFERENCE POINTS OF THE FIRST SENSING FRAME INFORMATION BY A DYNAMIC POSITION PREDICTION PROCEDURE, AND CHECKING IF TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION APPEAR AT THE PREDICTED POSITIONS
S32
YES
UPDATING THE ORIGINAL TOUCHING REFERENCE POINTS WITH THE PRESENT TOUCHING
S33
NO
DETERMINING IF THE SECOND SENSING FRAME INFORMATION HAS AT LEAST ONE NEW TOUCHING SENSING POINT
S34
YES
NO
MAINTAINING THE TOUCHING REFERENCE POINT
S35

FIG. 9

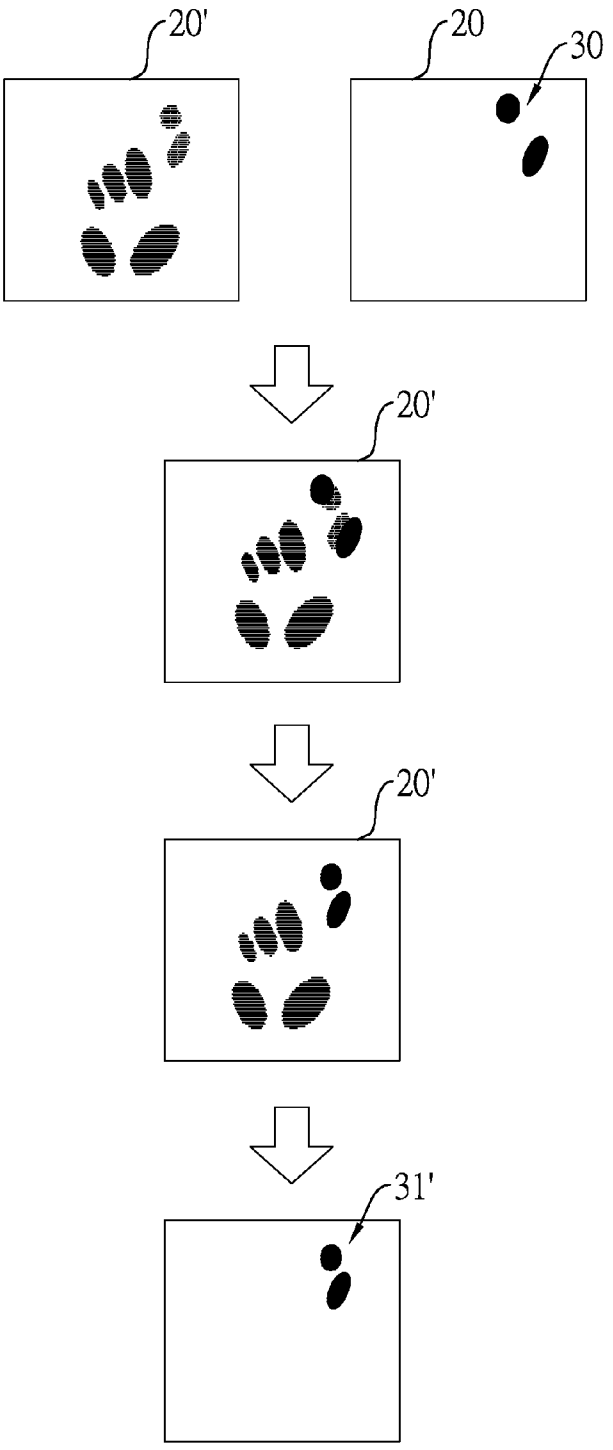


FIG. 10A

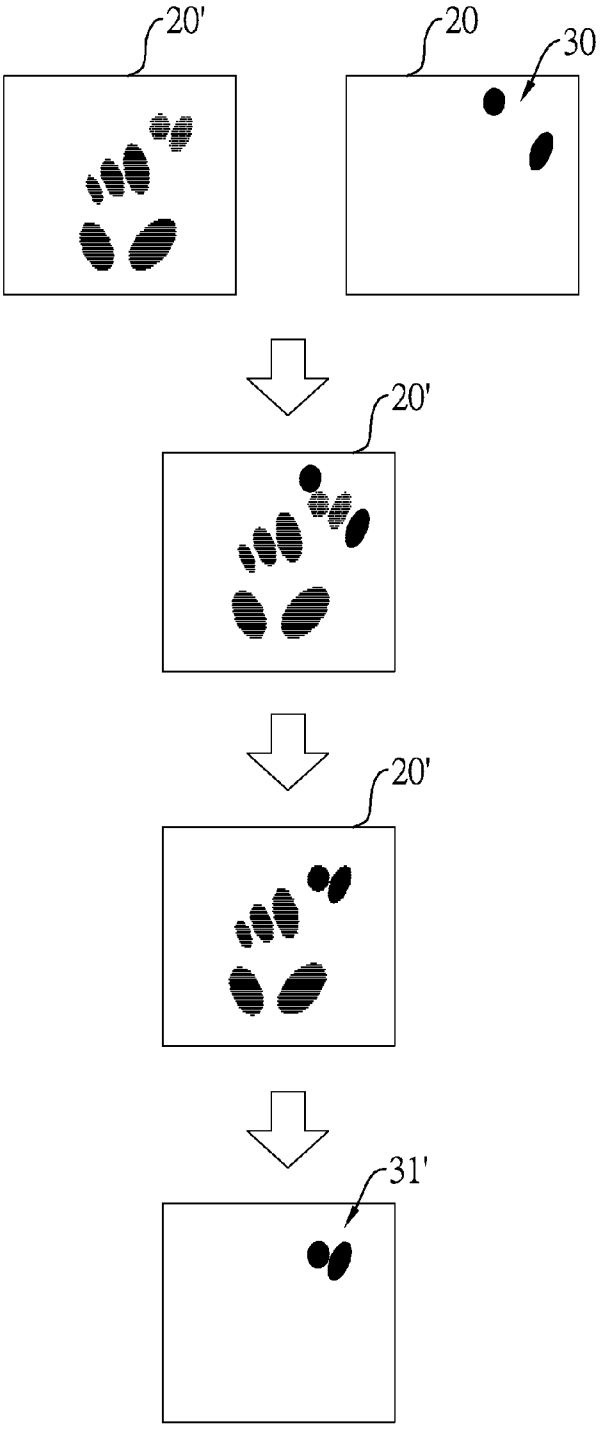


FIG. 10B

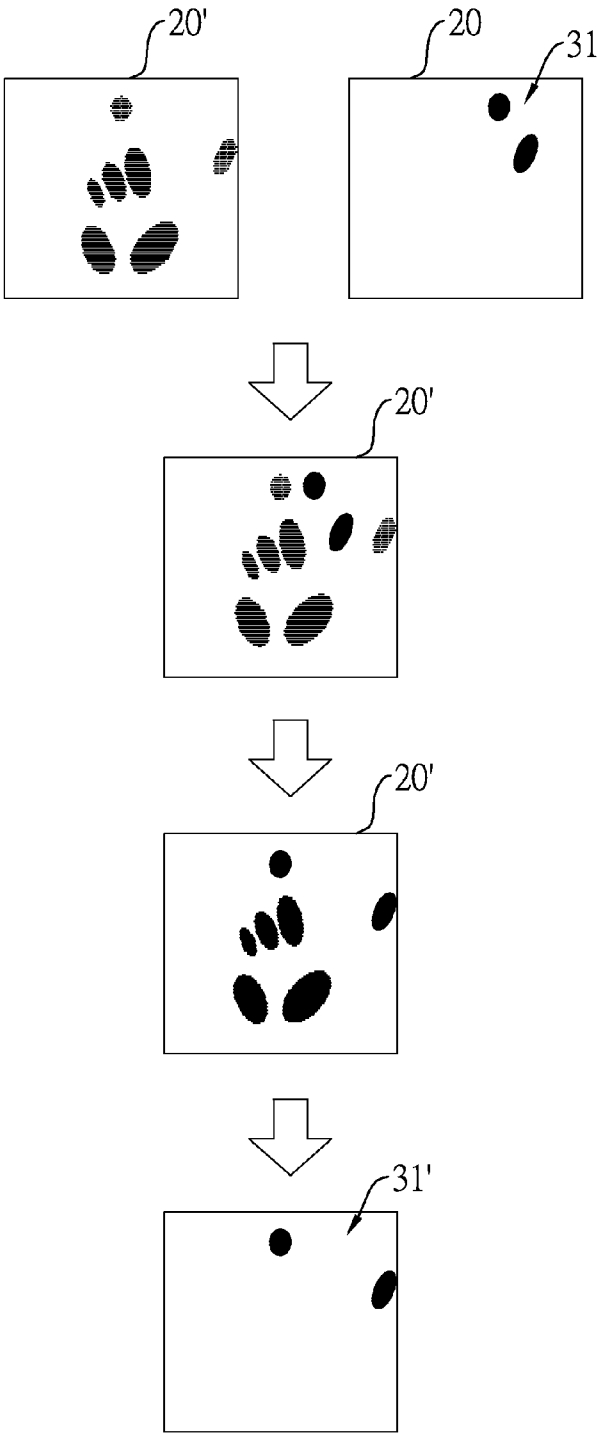


FIG. 10C

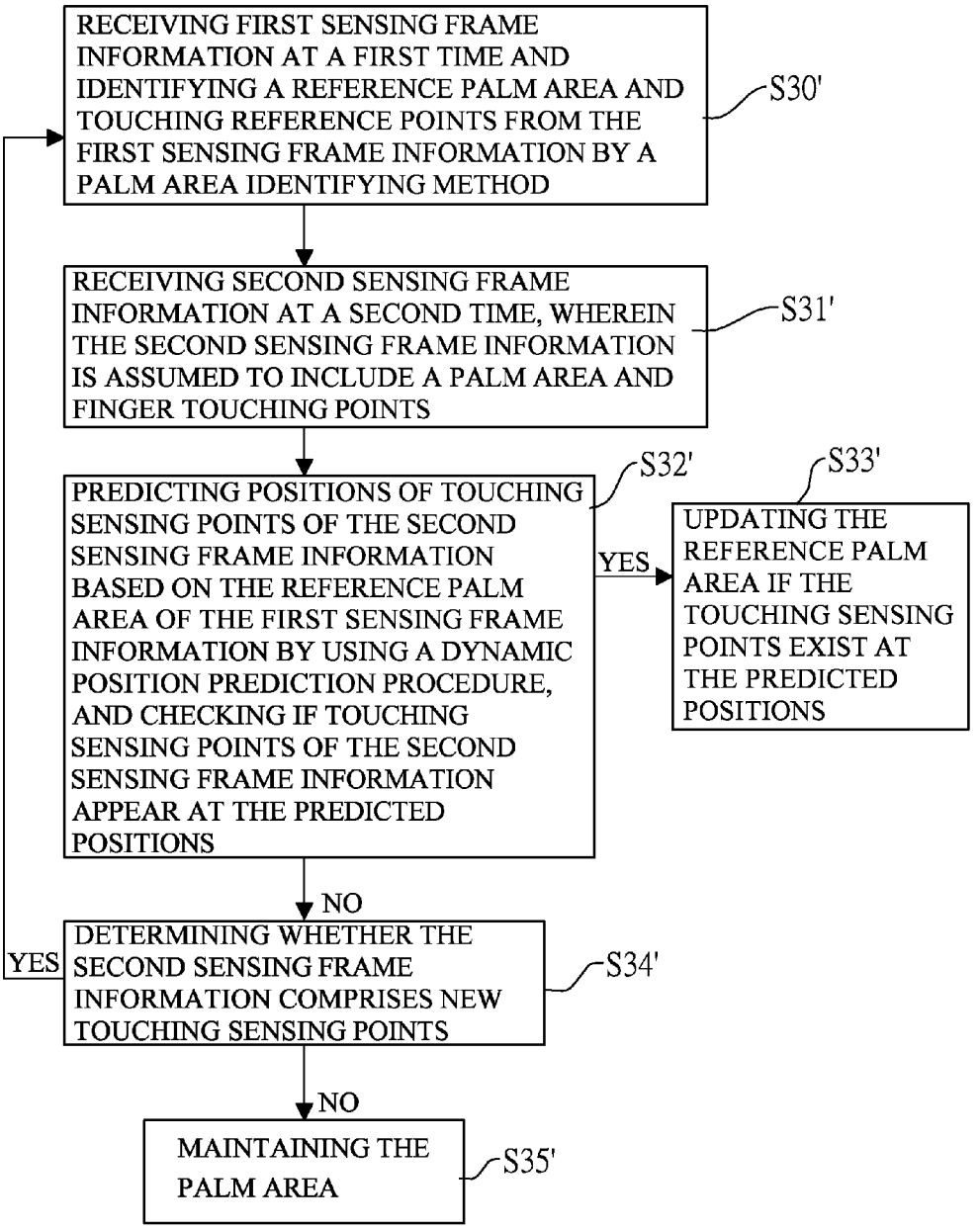

RECEIVING FIRST SENSING FRAME INFORMATION AT A FIRST TIME AND IDENTIFYING A REFERENCE PALM AREA AND TOUCHING REFERENCE POINTS FROM THE FIRST SENSING FRAME INFORMATION BY A PALM AREA IDENTIFYING METHOD
S30'
RECEIVING SECOND SENSING FRAME INFORMATION AT A SECOND TIME, WHEREIN THE SECOND SENSING FRAME INFORMATION IS ASSUMED TO INCLUDE A PALM AREA AND FINGER TOUCHING POINTS
S31'
PREDICTING POSITIONS OF TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION BASED ON THE REFERENCE PALM AREA OF THE FIRST SENSING FRAME INFORMATION BY USING A DYNAMIC POSITION PREDICTION PROCEDURE, AND CHECKING IF TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION APPEAR AT THE PREDICTED POSITIONS
S32'
YES
UPDATING THE REFERENCE PALM AREA IF THE TOUCHING SENSING POINTS EXIST AT THE PREDICTED POSITIONS
S33'
NO
DETERMINING WHETHER THE SECOND SENSING FRAME INFORMATION COMPRISES NEW TOUCHING SENSING POINTS
S34'
YES
NO
MAINTAINING THE PALM AREA
S35'

FIG. 11

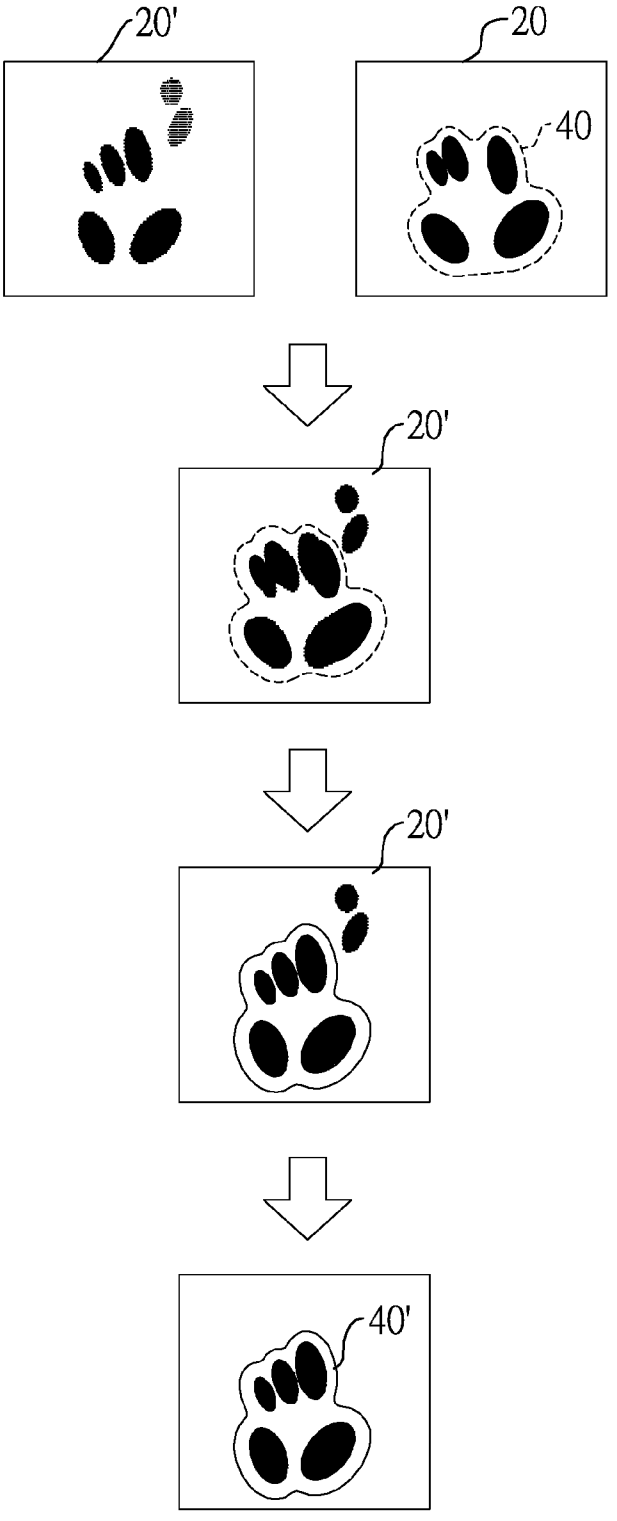


FIG. 12

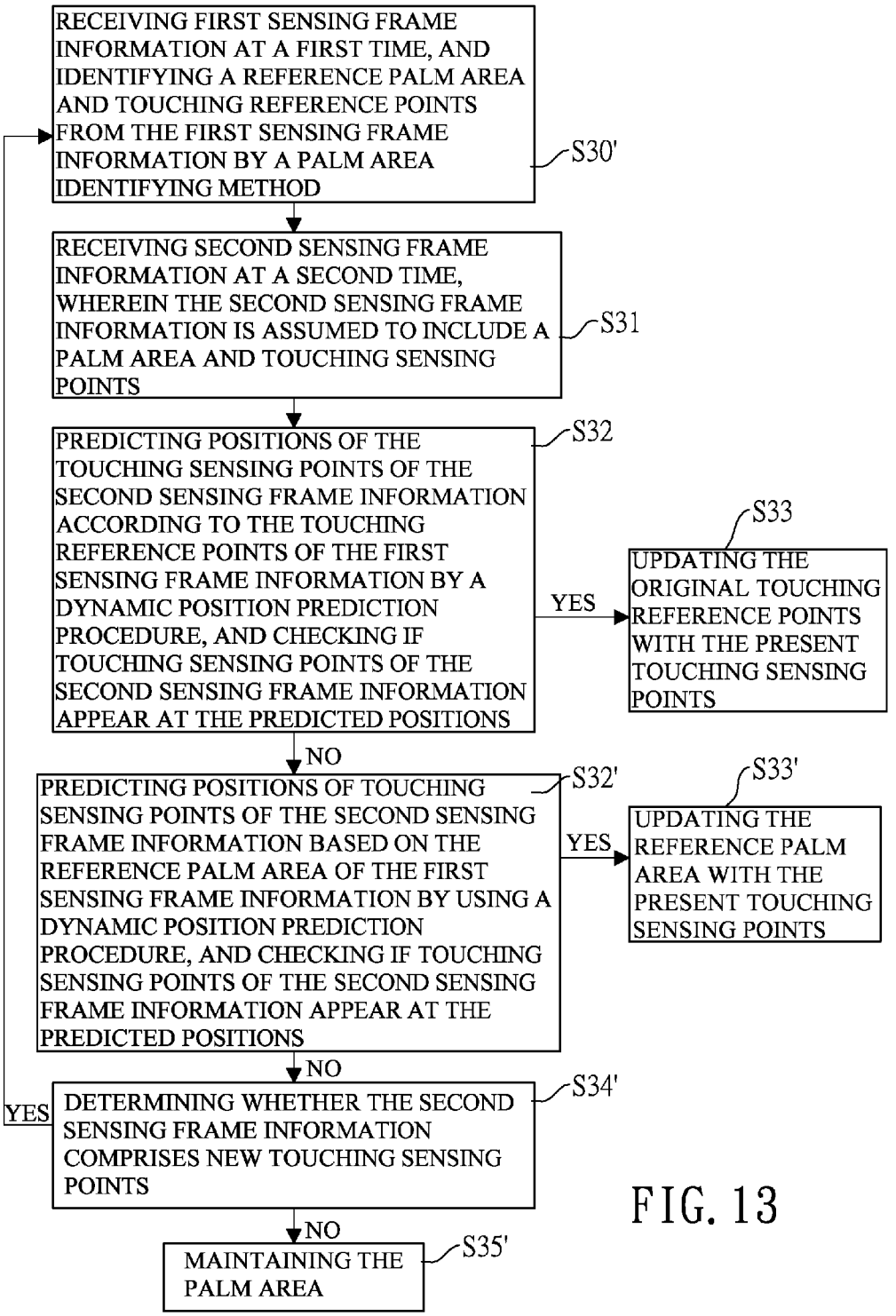

RECEIVING FIRST SENSING FRAME INFORMATION AT A FIRST TIME, AND IDENTIFYING A REFERENCE PALM AREA AND TOUCHING REFERENCE POINTS FROM THE FIRST SENSING FRAME INFORMATION BY A PALM AREA IDENTIFYING METHOD
S30'
RECEIVING SECOND SENSING FRAME INFORMATION AT A SECOND TIME, WHEREIN THE SECOND SENSING FRAME INFORMATION IS ASSUMED TO INCLUDE A PALM AREA AND TOUCHING SENSING POINTS
S31
PREDICTING POSITIONS OF THE TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION ACCORDING TO THE TOUCHING REFERENCE POINTS OF THE FIRST SENSING FRAME INFORMATION BY A DYNAMIC POSITION PREDICTION PROCEDURE, AND CHECKING IF TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION APPEAR AT THE PREDICTED POSITIONS
S32
YES
S33
UPDATING THE ORIGINAL TOUCHING REFERENCE POINTS WITH THE PRESENT TOUCHING SENSING POINTS
NO
PREDICTING POSITIONS OF TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION BASED ON THE REFERENCE PALM AREA OF THE FIRST SENSING FRAME INFORMATION BY USING A DYNAMIC POSITION PREDICTION PROCEDURE, AND CHECKING IF TOUCHING SENSING POINTS OF THE SECOND SENSING FRAME INFORMATION APPEAR AT THE PREDICTED POSITIONS
S32'
YES
S33'
UPDATING THE REFERENCE PALM AREA WITH THE PRESENT TOUCHING SENSING POINTS
NO
DETERMINING WHETHER THE SECOND SENSING FRAME INFORMATION COMPRISES NEW TOUCHING SENSING POINTS
S34'
YES
NO
MAINTAINING THE PALM AREA
S35'

FIG. 13

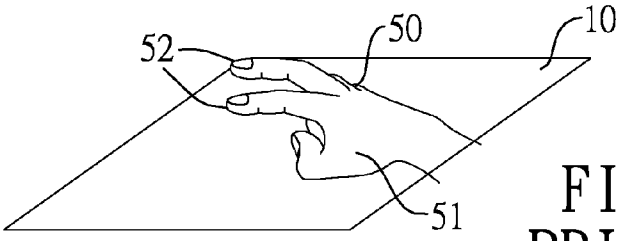


FIG. 14A
PRIOR ART

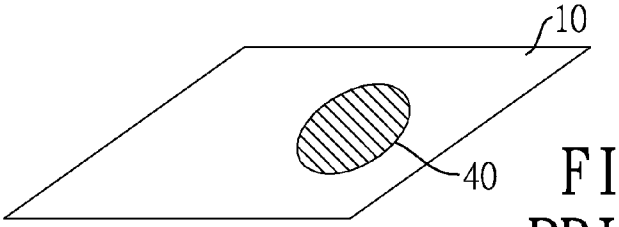


FIG. 14B
PRIOR ART

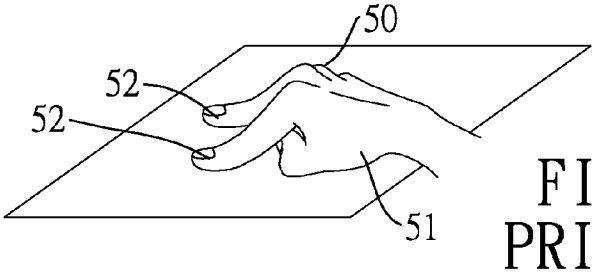


FIG. 14C
PRIOR ART

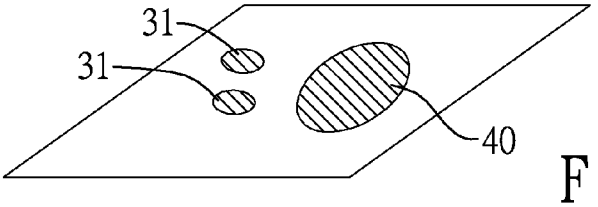


FIG. 14D
PRIOR ART

METHOD OF IDENTIFYING PALM AREA FOR TOUCH PANEL AND METHOD FOR UPDATING THE IDENTIFIED PALM AREA

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of identifying touch points on a touch panel and, in particular, to a method of identifying a palm area for a touch panel and a method for updating the identified palm area.

2. Description of Related Art

Touch panels are very popular input devices applied in an electronic product area or a computer product area. The touch panel can substitute for buttons or keyboards, so electronic products or computer products equipped with the touch panel can be fabricated in a more compact size. The touch panel also provides a hand-writing function allowing a user to directly operate the electronic products.

Touch panels are categorized into many types such as a single touch type or a multi-touch type, wherein the multi-touch type is more popular. The multi-touch panel can only recognize the presence of multiple fingers to determine which function should be performed, such as the screen scaling function and the drag-and-drop function. When the foregoing recognizing method is applied to the small-size touch panel such as the panel of a smart phone, using the fingers to operate the touch panel may not cause any inconvenience. However, as the large-size touch panel comes to the market, the multi-finger based reorganization method may not meet the user's habits. For example, when the user views electronic-books or news via the touch panel, the user may unintentionally put the entire palm on the touch panel. The contact of the palm with the touch panel will cause an error. To improve the identifying methods, U.S. Pat. Publication No. 2011/0012855 discloses a multi-touch device and method for palm rejection. Normally, when a user puts fingers and a palm on a multi-touch panel, the palm will be regarded as a valid touching point. The U.S. patent publication discloses a method for rejecting the touched palm area as shown in FIGS. **14**A to **14**D, wherein the method comprises:

continuously receiving images including touching points from a touch panel **10**;

searching at least one first touching area such as a palm area **40** from the images before fingers **52** or a stylus touching the touch panel **10**;

defining at least an untouched area by the at least one first touching area; and

recognizing a touch point being out of the palm area **40** as a reference point, wherein the touch point corresponds to a finger touch or a stylus touch as a reference point **31**.

For rejecting the palm area **40**, the user must touch the touch panel by a palm **51** at first as shown in FIG. **14**A to correctly define the palm area **40**. With reference to FIGS. **14**B and **14**C, after the palm area **40** is defined as an ineffective area, the user can operate the touch panel by the fingers **52** or the stylus. Thus positions of the touching reference points **31** can be correctly identified as shown in FIG. **14**D. In the foregoing approaches, the user is required to set the palm area **40** in advance. Therefore, the approach indirectly limits the user's operating habits and is not practical enough.

SUMMARY OF THE INVENTION

An objective of the invention is to provide a method of identifying a palm area for a touch panel to correctly recognize the valid touching points on the touch panel.

To achieve the above-mentioned objective, the method of identifying the palm area comprises the steps of:

receiving sensing frame information including multiple touching sensing points from the touch panel;

selecting one of the touching sensing points;

outwardly extending a distance from an outline of the presently selected touching sensing point to form a searching range;

checking whether an outline of any one of other touching sensing points overlaps the searching range;

if so, marking the presently selected touching sensing point, ,and selecting another one of the touching sensing points to return to the step of extending the distance;

if not, selecting another one of the touching sensing points to return to the step of extending the distance until all of the touching sensing points have been checked; and

merging all outlines of the marked touching sensing points together to form a final outline as a palm area, and defining other unmarked touching sensing points as touching reference points.

The invention further provides an updating method for tracking the palm area, the method having the steps of:

receiving first sensing frame information at a first time, and identifying a reference palm area and touching reference points from the first sensing frame information by a palm area identifying procedure, wherein the palm area identifying procedure further comprises the steps of:

receiving multiple touching sensing points from the first sensing frame information;

selecting one of the touching sensing points;

outwardly extending a distance from an outline of the selected touching sensing point to form a searching range;

reading the outlines of other touching sensing points, and checking whether an outline of any one of other touching sensing points overlaps the searching range;

if so, marking the touching sensing point, and selecting another one of the touching sensing points to return to the step of extending the distance to update the searching range;

if not, selecting one of the touching sensing points to return to the step of extending the distance until all of the touching sensing points have been checked; and

merging all outlines of the marked touching sensing points together to form a final outline as the reference palm area, and defining other unmarked touching sensing points as touching reference points;

receiving second sensing frame information at a second time;

predicting positions where the touching sensing points of the second sensing frame information will appear by a dynamic position prediction procedure based on positions of the touching reference points of the first sensing frame information; and

updating the touching reference points with the present touching sensing points if the present touching sensing points of the second sensing frame information appear at the predicted positions.

The invention yet further provides a method for updating the palm area, the method having the steps of: receiving first sensing frame information at a first time, and identifying a reference palm area and touching reference points from the first sensing frame information by a palm area identifying procedure, wherein the palm area identifying procedure further comprises the steps of:

receiving multiple touching sensing points from the first sensing frame information;

selecting one of the touching sensing points;

outwardly extending a distance from the outline of the selected touching sensing point to form a searching range;

reading the outlines of other touching sensing points, and checking whether the outline of any one of other touching sensing points overlaps the searching range;

if so, marking the touching sensing point, and selecting another one of the touching sensing points to return to the step of extending the distance;

if not, selecting one of the touching sensing points to return to the step of extending the distance until all of the touching sensing points have been checked; and

merging all outlines of the marked touching sensing points together to form a final outline as the reference palm area, and defining other unmarked touching sensing points as touching reference points;

receiving second sensing frame information at a second time;

predicting a palm area of the second sensing frame information by a dynamic position prediction procedure based on the reference palm area of the first sensing frame information; and

determining whether touching sensing points of the second sensing frame information appear in the predicted palm area;

updating the reference palm area if the touching sensing points of the second sensing frame information appear at the predicted palm area.

When a user puts the palm on the touch panel and operates the touch panel with fingers or a stylus, the invention is able to correctly recognize a palm area, finger touching points or a stylus touching point upon receiving sensing frames and further to update the recognized palm area and touching points. Thus, even though the finger touching points and the stylus touching point are very close to the palm area, the finger touching points and the stylus touching point can be correctly identified. The user thus can operate the touch panel without particular operating limitations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a flowchart of a first embodiment of a method of identifying a palm area in accordance with the present invention;

FIGS. **2**A to **2**E are schematic diagrams of sensing frame information corresponding to FIG. **1**;

FIG. **3** is a flowchart of a second embodiment of a method of identifying a palm area in accordance with the present invention;

FIGS. **4**A to **4**E are schematic diagrams of sensing frame information corresponding to FIG. **3**;

FIGS. **5**A and **5**B are operational views showing a full palm and a touching contact performed by a finger;

FIGS. **6**A and **6**B are schematic diagrams of sensing frames respectively corresponding to FIGS. **5**A and **5**B;

FIGS. **7**A and **7**B are operational views showing a full palm and multiple touching contacts performed by different fingers;

FIGS. **8**A and **8**B are schematic diagrams of sensing frames respectively corresponding to FIGS. **7**A and **7**B;

FIG. **9** is a flowchart of a first embodiment of an updating method in accordance with the present invention;

FIG. **10**A is a first schematic diagram of sensing frames corresponding to FIG. **9**;

FIG. **10**B is a second schematic diagram of sensing frames corresponding to FIG. **9**;

FIG. **10**C is a third schematic diagram of sensing frames corresponding to FIG. **9**;

FIG. **11** is a second embodiment of a flowchart of an updating method in accordance with the present invention;

FIG. **12** is a schematic diagram of sensing frames corresponding to FIG. **11**;

FIG. **13** is a third embodiment of a flowchart of an updating method in accordance with the present invention; and

FIGS. **14**A to **14**D are operational views disclosed by U.S. Pat. Publication No. 2011/0012855.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

This invention is a method of identifying a palm area for a touch panel by continuously receiving scan frames of the touch panel.

With reference to FIGS. **1** and **2**A to **2**E, a first preferred embodiment of the method comprises the steps as follows.

Receiving sensing frame information **20** containing multiple touching sensing points **30** from the touch panel (S**10**).

Selecting one of the touching sensing points **30** and determining an outline of the presently selected touching sensing point **30'** (S**11**). In this embodiment, the first selected touching sensing point **30'** is selected by referring to a palm feature. The palm feature comprises a maximum sensing range, a maximum capacitance sensing value, an outline of the palm, a slope value determined by the sensing range and the capacitance sensing value, or a minimum ratio of the moving speed to the sensing range. When the moving speed and sensing range of each sensing point are obtained, the ratio of moving speed to the sensing range of each sensing point can be calculated and the minimum ratio can be used as palm features. Contrary to the palm feature, the first selected touching sensing point can be selected based on a non-palm feature. The non-palm feature comprises a sensing range except the maximum sensing range, a capacitance sensing value except the maximum capacitance sensing value, outlines of fingers or a stylus, a slope value determined by the sensing range and the capacitance sensing value, a ratio of moving speed to the sensing range except to the minimum ratio, etc.

Outwardly extending a distance from the outline of the presently selected touching sensing point **30'** to form a searching range (S**12**). The searching range is defined by outwardly extending a distance from a complete outline of the selected touching sensing point **30'** or from a partial outline of the presently selected touching sensing point **30'**. If the searching range is defined by referring to the complete outline, that means the searching range is defined by extending a distance from all points around the edge showing the shape of the presently selected touching sensing point **30'**. If the searching range is defined by referring to the partial outline, that means the searching range is defined by extending a distance from only a part of points around the edge of the selected touching sensing point **30'**.

Reading an outline of any one of other touching sensing points **30**, and checking whether the outline of any one of other touching sensing points **30** overlaps the searching range (S**13**).

If so, marking the presently selected touching sensing point **30'** , and selecting another one of the touching sensing points **30**(S**14**) to return to the step S**12**.

If not, selecting another one of the touching sensing points **30** to return to the step S**12** until all of the touching sensing points **30** have been checked (S**15**).

Merging all outlines of the marked touching sensing points **30'** together to form a final outline as a palm area **40**, and

defining other unmarked touching sensing points **30** as touching reference points **31** induced by fingers or a stylus (S**16**).

With reference to FIGS. **5**A and **5**B, since the valid touching reference point **31** in this example is produced by the thumb **52'**, other touching sensing points except those induced by the thumb **52'** are integrated as the palm area **40** in the sensing frames **20***a* and **20***b* as shown in FIGS. **6**A and **6**B. Thus, the touching sensing points **30'** are selected based on the non-palm feature and integrated as the palm area **40**. Because the touching sensing point corresponding to the thumb **52'** does not overlap the searching range, the touching sensing point corresponding to the thumb **52'** is not incorporated in the palm area **40** and is defined as the valid touching reference point **31**. Therefore, even though a user touches the touch panel **10** by the full palm **50**, the palm area **40** still can be correctly identified.

With reference to FIGS. **7**A and **7**B, a multi-touch gesture is performed by the thumb and the index finger. Except the two touching reference points **31** corresponding to the thumb and the index finger, other touching sensing points **30'** are integrated as a palm area **40** in the sensing frames **20***c* and **20***d* as shown in FIGS. **8**A and **8**B. The two touching reference points **31** corresponding to the thumb and the first finger are deemed valid. When the user uses this full palm touching operating gesture to touch the touch panel **10**, the available touched palm area **40** can be correctly identified.

With further reference to FIGS. **3** and **4**A to **4**E, a second embodiment of the method of identifying a palm area in accordance with the present invention comprises the steps as follows.

Receiving sensing frame information **20** comprising multiple touching sensing points **30** from the touch panel (S**20**).

Defining one of the multiple touching sensing points **30'** as a palm touching area by referring to a palm feature (S**21**). The palm feature comprises a maximum sensing range, a maximum capacitance sensing value, an outline of the palm, a slope value determined by the sensing range and the capacitance sensing value, or a minimum ratio of the moving speed to the sensing range. When the moving speed and sensing range of each sensing point are obtained, the ratio of moving speed to the sensing range of each sensing point can be calculated and the minimum ratio can be used as palm features.

Selecting one of other touching sensing points **30'** and determining an outline of the selected touching sensing point **30'**(**522**).

Outwardly extending a distance from the outline of the presently selected touching sensing point **30'** to form a searching range (S**23**).

Reading an outline of the palm touching area, and checking whether the palm touching area overlaps the searching range (S**24**).

If so, marking the presently selected touching sensing point **30'** and further incorporating the marked touching sensing point **30'** into the palm touching area to update the palm touching area (S**25**). Determining if any one of touching sensing points is unchecked (S**26**), and returning to the step S**22** if any one of touching sensing points is unchecked.

If not, returning to the step S**22**.

Defining the final updated palm touching area as the palm area **40** and defining other touching sensing points **30'** outside the palm area **40** as touching reference points **31** induced by fingers or a stylus (S**27**).

In practical use, users will move their palms and fingers on the touch panels. Therefore, the present invention provides an updating method for the palm area. With the updating method, even though the fingers or a stylus are very close to the palm area, the fingers or the stylus still can be correctly recognized. With reference to FIGS. **9** and **10**A, a first embodiment of the updating method comprises the steps as follows.

receiving first sensing frame information at a first time, and identifying a reference palm area and touching reference points **31** from the first sensing frame information by a palm area identifying method (S**30**), wherein the palm area identifying method comprises the steps mentioned above and shown in FIG. **1**;

receiving second sensing frame information **20'** at a second time, wherein the second sensing frame information **20'** is assumed to include a palm area and touching sensing points (S**31**);

predicting positions of the touching sensing points of the second sensing frame information **20'** according to the touching reference points **31** of the first sensing frame information **20** by a dynamic position prediction procedure, and checking if touching sensing points of the second sensing frame information **20'** appear at the predicted positions (S**32**);

updating the original touching reference points **31'** with the present touching sensing points if the present touching sensing points of the second sensing frame information **20'** appear at the predicted positions (S**33**);

determining if the second sensing frame information **20'** has at least one new touching sensing point (S**34**);

returning to the step S**30** to redefine the palm area and the touching reference points **31** if the second sensing frame information **20'** includes at least one new touching sensing point; and

maintaining the touching reference point **31** if there is no new touching sensing point in the second sensing frame information **20'**(S**35**).

In this embodiment, the dynamic position prediction procedure directly takes the position of the touching reference point **31** as the predicted position. In applications wherein the finger or the stylus moves slowly on the touch panel, the dynamic position prediction procedure determines if touching sensing points appear near the touching reference points **31**, i.e. determines if new touching sensing points of the second sensing frame information **20'** overlap the touching reference points **31**.

Further, the dynamic position prediction procedure can be a shortest-distance prediction approach, a moving-direction prediction approach or other prediction approaches. The shortest-distance prediction approach is suitable for applications wherein the touching sensing points move relatively faster. With reference to FIG. **10**B, because the finger touching points in the second sensing frame information **20'** and the reference points **31** are at different positions, the distance from each touching sensing point **30** of the second sensing frame information **20'** to the touching reference points **31** is calculated. The positions of the touching sensing points **30** with the shortest distances to the touching reference points **31** are chosen as the predicted positions. If new touching sensing points **30** appear at the predicted positions, the touching reference points **31** will be updated by the new touching sensing points **30**.

With reference to FIG. **10**C, the moving-direction prediction approach is applied in situations that the touching sensing points move much faster to continuously track position information of the finger touching points from a plurality of sensing frames during a first time and a second time. The direction prediction approach tracks moving directions of the finger touching points, predicts positions where the finger touching points of the second sensing frame information **20'**

are going to be located based on the moving directions, thus determines whether the original touching reference point **31** should be updated.

With reference to FIGS. **11** and **12**, a second embodiment of an updating method comprises the steps of:

receiving first sensing frame information at a first time and identifying a reference palm area **40** and touching reference points from the first sensing frame information by a palm area identifying method (S**30'**), wherein the palm area identifying method comprises the steps mentioned above and shown in FIG. **1**;

receiving second sensing frame information **20'** at a second time, wherein the second sensing frame information **20'** is assumed to include a palm area and finger touching points (S**31'**);

predicting positions of touching sensing points of the second sensing frame information **20'** based on the reference palm area **40** of the first sensing frame information **20** by using a dynamic position prediction procedure, and checking if touching sensing points of the second sensing frame information appear at the predicted positions (S**32'**);

updating the reference palm area **40** if the touching sensing points of the second sensing frame information exist at the predicted positions (S**33'**);

further determining whether the second sensing frame information comprises new touching sensing points (S**34'**) if the touching sensing points do not exist at the predicted positions;

returning to the first step S**30'** to redefine the palm area and the touching reference point if the second sensing frame information comprises new touching sensing points; and

maintaining the palm area **40** if the second sensing frame information does not comprise new touching sensing points (S**35'**).

In the second embodiment of the updating method, the dynamic position prediction procedure directly defines the palm area **40** as the predicted position. In applications wherein the finger or the stylus moves slowly on the touch panel, the dynamic position prediction procedure determines if any touching sensing point appears near the palm area **40**, i.e. determines if any touching sensing point of the second sensing frame information **20'** overlaps the palm area **40**.

Furthermore, the dynamic position prediction procedure can be a shortest-distance prediction approach, a moving-direction prediction approach or other prediction approaches. The shortest-distance prediction approach is suitable for applications wherein the touching sensing points move relatively faster. Because the palm touching points of the second sensing frame information **20'** and the palm area **40** are at different positions and do not overlap each other, the distances between each touching sensing point of the second sensing frame information **20'** and the palm area **40** are calculated to determine a shortest distance. The position of the touching sensing point having the shortest distance from the palm area is chosen as the predicted position.

The moving-direction prediction approach is applied in situations that the touching sensing points move much faster to continuously receive position information of the palm touching points from a plurality of sensing frames during the first time and the second time. The moving-direction prediction approach records moving directions of the palm touching points, predicts positions where the palm touching point of the second sensing frame information **20'** will be located based on the moving directions, thus determines whether the palm area should be updated.

The two updating methods described above can be combined as another embodiment. With reference to FIG. **13**, the third embodiment first sequentially executes the steps S**30** to S**33** shown in FIG. **9** for updating the touching sensing points **31**, and then executes the steps S**32'** to S**35'** shown in FIG. **11** to update the full palm including the touching reference points **31** and the palm area **40**.

As a consequence, this invention finds a palm area as an invalid touching point from multiple touching sensing points induced by a full palm without limiting the user's operation habits. The valid touching sensing points of fingers or a stylus can be correctly identified. With reference to FIGS. **3**A and **5**A, this invention can accomplish a full palm touching function allowing the users to conveniently operate the touch panel.

What is claimed is:

1. A method of identifying a palm area for a touch panel, comprising the steps of:

receiving sensing frame information including multiple touching sensing points from the touch panel;

selecting one of the touching sensing points;

outwardly extending a distance from an outline of the presently selected touching sensing point to form a searching range;

checking whether an outline of any one of other touching sensing points overlaps the searching range;

if so, marking the presently selected touching sensing point, and selecting another one of the touching sensing points to return to the step of extending the distance;

if not, selecting another one of the touching sensing points to return to the step of extending the distance; and

merging all outlines of the marked touching sensing points together to form a final outline as a palm area.

2. The method as claimed in claim **1**, wherein the first selected touching sensing point is selected based on a palm feature.

3. The method as claimed in claim **1**, wherein the first selected touching sensing point is selected based on a non-palm feature.

4. The method as claimed in claim **2**, wherein the palm feature is selected from a maximum sensing range, a maximum capacitance sensing value, an outline of the palm, a slope value, or a minimum ratio of moving speed to sensing range.

5. The method of identifying the palm area as claimed in claim **3**, wherein the non-palm feature is selected from a sensing range except the maximum sensing range, a capacitance sensing value except the maximum capacitance sensing value, outlines of fingers or a stylus, a slope value, or a ratio of moving speed to sensing range except the minimum ratio.

6. The method as claimed in claim **1**, wherein the searching range is defined by outwardly extending the distance from complete outline of the touching sensing point.

7. The method as claimed in claim **2**, wherein the searching range is defined by outwardly extending the distance from complete outline of the touching sensing point.

8. The method as claimed in claim **3**, wherein the searching range is defined by outwardly extending the distance from complete outline of the touching sensing point.

9. The method as claimed in claim **4**, wherein the searching range is defined by outwardly extending the distance from complete outline of the touching sensing point.

10. The method as claimed in claim **5**, wherein the searching range is defined by outwardly extending the distance from complete outline of the touching sensing point.

11. The method as claimed in claims **1**, wherein the searching range is defined by outwardly extending the distance from partial outline of the touching sensing point.

12. The method as claimed in claim 2, wherein the searching range is defined by outwardly extending the distance from partial outline of the touching sensing point.

13. The method as claimed in claim 3, wherein the searching range is defined by outwardly extending the distance from partial outline of the touching sensing point.

14. The method as claimed in claim 4, wherein the searching range is defined by outwardly extending the distance from partial outline of the touching sensing point.

15. The method as claimed in claim 5, wherein the searching range is defined by outwardly extending the distance from partial outline of the touching sensing point.

16. A method of identifying a palm area for a touch panel, the method comprising the steps of:

(a)receiving sensing frame information containing multiple touching sensing points from the touch panel;

(b) defining one of the touching sensing points as a palm touching area based on a palm feature;

(c) selecting one of other touching sensing points and determining an outline of the selected touching sensing point;

(d) outwardly extending to distance from the outline of the presently selected touching sensing point to form a searching range;

(e) reading an outline of the palm touching area and checking whether the palm touching area overlaps the searching range,

if so, marking the presently selected touching sensing point, further incorporating the marked touching sensing point into the palm touching area, and returning to the step (c);

if not, returning to the step (c); and

(f) defining the final updated palm touching area as a palm area.

17. The method as claimed in claim 16, wherein the palm feature is selected from a maximum sensing range, a maximum capacitance sensing value, an outline of the palm, a slope value or a minimum ratio of moving speed to sensing range.

18. The method as claimed in claim 16, wherein the searching range is defined by outwardly extending the distance from complete outline of the touching sensing point.

19. The method as claimed in claim 17, wherein the searching range is defined by outwardly extending the distance from complete outline of the touching sensing point.

20. The method as claimed in claim 16, wherein the searching range is defined by outwardly extending the distance from partial outline of the touching sensing point.

21. The method as claimed in claim 17, wherein the searching range is defined by outwardly extending the distance from partial outline of the touching sensing point.

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